



PRESENTED TO

TOWN OF FALMOUTH, AND
CITIES OF ROCKLAND, SOUTH PORTLAND AND
BIDDEFORD, MAINE

02/25/2016 – 2:00 PM

RESPONSE TO REQUEST FOR QUALIFICATIONS

CONVERSION OF COMMUNITY STREET LIGHT SYSTEM TO LED FIXTURES AND FROM UTILITY OWNED TO MUNICIPALLY OWNED AND MAINTAINED FIXTURE ON UTILITY OWNED POLES

*CITIES OF ROCKLAND, SOUTH PORTLAND AND BIDDEFORD;
AND TOWN OF FALMOUTH, MAINE*



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Contents

A.	Covering Letter	2
B.	Company Profile.....	3
C.	Key Personnel	6
D.	References	9
E.	Approach	15
	1.Audit.....	18
	2.Financial Stability	23
	3.Design.....	24
	4.Project Management	28
	5.Technology Procurement	34
	a.Fixtures.....	34
	b.Smart Controls and other PM Smart City Solutions	37
	6.Installation & Maintenance	39
	7.Construction Administration	41
	8.Acquisition of Streetlights	42
	9.Rebates/Incentives	42
F.	Value Added Services	44
G.	Additional Information	45
H.	Project Schedule	46

A. Covering Letter

February 25, 2016

Mr. Nathan Poore
Town Manager, Town of Falmouth
271 Falmouth Road
Falmouth, Maine 04105

Dear Mr. Poore,

On behalf of The Efficiency Network, Inc. (TEN), I am pleased to present you with TEN's response to the Request for Qualifications for the conversion of community street lighting systems in Rockland, South Portland, Biddeford, and Falmouth (the PM's) to LED technology, and from utility owned to municipally owned and maintained fixtures on utility owned poles.

TEN is a national leader in helping 21st Century cities implement ground-breaking street lighting solutions. To date, TEN has actively worked on developing solutions for nearly 150,000 street lights across the United States. Our proven approach has helped cities save millions of dollars annually on utility bills while dramatically reducing energy and maintenance costs while creating new revenue streams.

TEN will work with participating municipalities at each step of the project – from audit, to contract, and installation – to develop, plan, and execute a retrofit of the street lighting systems, using state-of-the-art technologies. And TEN will deliver a 100% accurate audit to each PM in terms of locating, by GPS, each street lighting system asset. TEN is vendor neutral and through our proven process, we will work to help each participating PM select the fixtures that best meet their needs, to their ultimate benefit in terms of price and technology performance.

TEN has the expertise, experience, and national network of partners in place to deliver a world class lighting project for the Cities of Rockland, South Portland, Biddeford, and the Town of Falmouth.

We thank you for the opportunity to submit this response and we look forward to working with you.

Patrick Regan

Patrick Regan, VP Streetlight/Smart Cities Technology Solutions
The Efficiency Network, Inc. (TEN)

B. Company Profile

The Efficiency Network, Inc. (TEN) is one of the nation’s industry-leading LED street lighting design, conversion, and Smart Cities technology integration companies. TEN’s smart street lighting solutions deliver lower costs, better lights, safer streets and brighter, more beautiful communities.

TEN is a Delaware Corporation headquartered in the Commonwealth of Pennsylvania, in the City of Pittsburgh. TEN has been in the energy-efficiency and Smart City solutions business since its incorporation in February 2012 and has operated under this firm name for nearly four years. Despite the relatively short amount of time that TEN has been established, TEN’s in-house team has designed and implemented over \$500 million in energy efficiency projects for a multitude of customers over the past several years. TEN’s seasoned professionals have, in the past, worked in material roles for some of the country’s most well-known energy efficiency companies, including TEN, Siemens, Johnson Controls, NORESKO, and Constellation Energy.

TEN’s commitment to offering street lighting and Smart Cities technology solutions is evident based on the credentialed, high-caliber team assembled at TEN to provide world-class energy efficiency – including a significant focus on performance contracting which encompasses, to a large extent, municipality-wide roadway and street lighting LED conversions, as well as smart energy efficiency projects. This is our exclusive focus. There are few, if any, energy and utility situations TEN has not already encountered and successfully addressed (this year) for other street lighting clients such as the cities of Baltimore, MD, Harrisburg, PA and Bethlehem, PA.

TEN can bring these same capabilities and customer successes to each PM by working with them to identify their unique needs to complete the LED street lighting conversion project.

Project Responsibilities

TEN will develop a comprehensive customized design for each individual PM’s street lighting conversion. Below is a list of the street lighting services TEN will provide for each PM, all in-house with our own employees:

Auditing & GIS/GPS pole locating	Energy Savings Calculations, including Paybacks
Design; Engineering	Cost Estimating
Competitive Procurement/Supply of Equipment from Vendors and Manufacturers	Subcontractor Bid Solicitation & Evaluation
Construction Management	Contractor Site Supervision
Monitoring and Verification	Commissioning & Smart Cities Technology Integration
Guaranteed Energy Savings	Rebate & Incentive Application & Administration
Utility Analysis & Energy Bill Reconciliation	Project Financial Analysis, Pro formas & Cash flows
Project Opportunity Identification & Recommendations	Warranty/repair Administration

Experience and Performance Capabilities

In addition to substantial energy performance contracting design and implementation experience, and the references of TEN’s team, TEN itself carries with it the Qualified Energy Service Company (ESCO) Certification by the United States Department of Energy (DOE). This designation is proof of expertise and experience through a rigorous DOE qualification process and allows TEN to perform Energy Savings Performance Contracting (ESPC) at Federal agencies.

TEN’S Current Similar Partnerships

Project	Client Contact	Value
City of Bethlehem, PA	Michael Alkhal, P.E., Director, Public Works & City Engineer	\$3.8 million
City of Baltimore, MD	Brent Hooper, Street Lighting Superintendent	\$3.2 million
City of Harrisburg, PA	Wayne Martin, P.E., City Engineer	\$3.6 million

The **City of Baltimore, MD** selected TEN to manage their latest street lighting conversion to LED, beginning with a Phase I asset inventory audit and conversion of approximately 7,000 fixtures to LED which are located in 17 high-crime zones designated by the City. Enhanced public safety/homeland security is the primary focus of Baltimore’s Phase I project. So much so, that the City asked TEN to evaluate and recommend fixtures best suited to “overdrive them” in these areas to shine a light on potential criminal activity – with the added feature to be able to dim the LED in the future if necessary, as well as to be able to troubleshoot maintenance from a centralized location. This project is standalone and does not include groupings of municipalities.

The **City of Bethlehem, PA** selected TEN to replace 5,500 of the City’s existing High Pressure Sodium (HPS) street lamp fixtures with 60% more efficient LED fixtures. TEN’s Bethlehem project represents the largest and most comprehensive city-wide LED street light conversion project completed to date in Pennsylvania, including pilot projects already completed in Philadelphia and Pittsburgh – at least until TEN finalizes the conversion of all of the street lighting in the City of Harrisburg, PA (6,000+ fixtures) to LED in April 2016. In Bethlehem, TEN served as designer, project manager, and primary point of contact between Bethlehem and the local project installer and fixture manufacturers. Bethlehem chose Philips for their cobra heads as the result of a highly competitive bid process facilitated by TEN. This project is standalone and does not include groupings of municipalities.

In the **City of Harrisburg**, in addition to an Asset Inventory Audit, TEN is also undertaking an extensive historical analysis of utility billing for the streetlight system to determine any overcharges paid by Harrisburg to PPL Electric Utilities – known as TEN’s Overcharge Lookback Audit. To the extent that any overcharges are revealed, TEN will facilitate return of those payments to Harrisburg for as many years as permitted under applicable law.

Knowledge or Relevant Legislation, Standards, Available Grants and Rebate Programs.

For this initiative, TEN will seek any other rebates and financial incentives available for each participant. For example, as part of TEN’s street lighting conversion for the City of Bethlehem (PA), TEN obtained \$211,380 in rebates directly paid to the city by the local utility. In the case of the City of Harrisburg, TEN assisted in facilitating a \$500,000 grant awarded to Harrisburg specifically intended for the purchase of equipment related to Harrisburg’s LED street lighting conversion, as well as applying for \$277,374 in direct-pay rebates to the city under Pennsylvania’s Act 129 utility rebate program. As certain incentives are time and program sensitive, TEN will undertake careful planning to optimize and obtain maximum value of any and all incentives available to each PM. This project is standalone and does not include

groupings of municipalities.

Unique Technologies

In the past, TEN has introduced various cost saving and revenue generating ideas to cities across the United States. Our team will work with each Participating Municipality to identify what available technology best suits their needs and what is the most cost effective way(s) to implement the technology into the new street lighting system.

TEN Revenue Generation Opportunities/Ideas

Each participant's infrastructure may require some investment during the lighting system upgrade. Due to costs associated with potentially adding poles and fixtures, each PM may want to explore revenue generating smart city media technologies as an avenue to help support infrastructure upgrades while not incurring additional debt.



TEN has the expertise and the network available to guide the City in reviewing and proposing the implementation of Smart Cities technologies. TEN believes that revenue generation could become a key component of each participant's overall project. In fact, estimates by TEN, working with our partners at Smart City Media, LLC and Intellistreets (Illuminating Concepts) (discussed below) indicates that Rockland, South Portland, Biddeford and Falmouth could generate up to \$2.5 million in additional revenue with a Smart City Media/Intellistreets revenue generation platform.

These revenue generating platforms can be attached to lighting structures depending on the desired technology – or can be standalone kiosks.

Local Municipal Operations and Maintenance Requirement Knowledge

TEN's team has implemented lighting and efficiency projects across the nation, with each project requiring various levels of expertise to meet individual goals. TEN will work with the participating municipalities to identify key operations and maintenance requirements prior to implementation and audit by adhering to the specific requirements of Central Maine Power and each municipality.

Experience in Assisting Municipalities with Evaluation and Acquisition of Street Lights.

TEN has worked with the City of Harrisburg, PA, the City of Bethlehem, PA, and the City of Baltimore, MD to evaluate their individual street lighting systems by performing inventory audits and making professional recommendations. Currently, TEN is working with City of Harrisburg officials to finalize the purchase of several hundred streetlights. For more information on TEN's experience, Please See Section E. Approach, 8. Acquisition of Street Lights.

C. Key Personnel

TEN's team below consists of industry veterans that have 10 to 25 years of experience in the energy services industry. TEN was created to offer energy efficiency under an altogether different price level and economic terms to create unmatched value for our clients. It is important to note that TEN's key personnel referenced below (and assigned to this project) have worked for leading energy services companies such as TEN, Constellation Energy, NORESCO, Johnson Controls, Siemens, and others. Individual experience and resumes for TEN's Street Lighting Team may be found in Attachment 1.

Patrick Regan – VP of Street Lighting / Smart Cities Technology Solutions (Primary Point of Contact for each City). TEN's primary contact person for each City is Patrick Regan, TEN's VP of Street Lighting and Smart Cities Technology Solutions. Patrick will coordinate all of TEN's resources for each City, including contract negotiations. Patrick has a valuable combination of skills and experience, including being a licensed attorney, which enables him to understand and discuss customer contractual needs and requirements, as well as extensive hands-on experience in recognizing customer financing strategy and needs, including presentation and analysis of various financial options and grant programs to determine those best suited for a customer's project. Over the past several years, Patrick has had the direct responsibility for coordinating the delivery of over \$50 million in energy efficiency measures, including thousands of LED street lights.

Steve Black – Director of Regional Partnerships in New England (Local Contact). Steve will work closely with Patrick Regan, TEN's VP of Street Lighting and Smart Cities Technology Integration, through the duration of each Cities' project to ensure overall customer satisfaction.

Olivia Benson – Program Manager Street Lighting / Smart Cities Technology Solutions (Point of Contact for Financing Assistance along with TEN CFO Chris Niemiec). Olivia will assist in the overall development and internal management of the project and will manage project-related communications to ensure effective coordination to each Cities' satisfaction. After graduating from Carnegie-Mellon University, Olivia served as a policy director for the City of Pittsburgh where she managed and designed community-focused programming for city-wide implementation and led public affairs outreach strategies and education initiatives, while at the same time obtaining two master's degrees – an MS in Public Policy from the University of Pennsylvania and an MBA from Point Park University. As it relates to street lighting, Olivia is the Program Manager for TEN's conversion of over 6,000 streetlights to LED in the City of Harrisburg, PA, and 900 streetlights in the Borough of Middletown, PA, including the integration of meaningful outreach strategies to support and exceed customer expectations.

Dave Clark, RPA – VP of Construction. Dave is responsible for directing the project management staff, working on the development of new project design concepts and constructability, preparing scopes of work and bid specifications, and overseeing the project health and safety program. Dave has over 30 years of energy efficiency industry experience, and oversees the seamless transition of customer vision into design excellence and installed reality.

Joseph Statler - Director of Assessment & Construction (Point of Contact for Procurement of Installation & Maintenance Contractor and Installation Management). Joe has a 12-year record of success overseeing all phases of multimillion-dollar construction, infrastructure, efficiency and environmental projects for government, housing and private-sector clients. Joe is an outstanding professional who has extensive experience in supervising and managing energy efficiency programs and policy planning initiatives. **Joe is directly responsible for the success of TEN's conversion of over 5,500 street light fixtures to LED in the City of Bethlehem, PA and Joe's team currently are managing TEN's LED street**

lighting upgrade projects in the cities of Baltimore (7,000) and Harrisburg (6,000+), and will oversee project management for this project.

Mike Schneider, LC, CLEP, CPM - Senior Solutions Designer ([Point of Contact for Street Lighting Design, Utility Bill Reconciliation and Product Procurement](#)). Mike researches, designs, and oversees field installations and testing of high-quality, cost-effective lighting measures along with various other energy saving and capital improvement measures. His extensive field experience allows him to apply and revise designs in order to best meet all unique situations. Having worked with nearly 60 lighting manufacturers, Mike knows the lighting products, how they work, and the best applications for each option. Mike currently serves as an advisory member on the Illumination Engineering Society of North America's (IESNA) Energy Management Committee and Industrial Lighting Committee. In addition, Mike is a Lighting Certified Professional (LC) by the National Council of Qualifications for the Lighting Professions, and a Certified Lighting Efficiency Professional (CLEP) by the Association of Energy Engineers. **Mike is directly responsible for assisting the Cities of Bethlehem, Baltimore and Harrisburg in analyzing the efficiency and characteristics of several world-class LED cobra-head fixtures for possible selection, and Mike will serve in this same lead design role for the MAPC and the Awarding Authorities.**

Marty Moyer - Project Manager ([Primary Point of Contact for Onsite Project Management](#)). Marty is responsible for all onsite project management and subcontractor supervision during construction, and will ensure each worksite is safe and supervised in an effective and efficient manner. Marty will be a field supervisor during the lighting upgrade and as needed for the length of the project. **Currently, Marty is one of the Project Managers overseeing TEN's installation of over 6,000 streetlights in the City of Harrisburg and is directly responsible for - to date - an extremely successful installation.**

Bobby Hall - Project Manager ([Secondary Point of Contact for Onsite Project Management](#)). Bobby is responsible for all onsite project management and subcontractor supervision during construction, and will ensure the worksite is safe and supervised in an effective and efficient manner. Bobby will be a field supervisor during the lighting upgrade and as needed for the length of the project. **Currently, Bobby is one of the Project Managers for TEN's installation of over 6,000 streetlights in the City of Harrisburg and is directly responsible for - to date - an extremely successful installation.**

Greg Lok, PE, CEM – VP of Engineering ([Point of Contact for Streetlight Inventory Assessment](#)). Greg is an energy management and controls specialist that develops individual projects, manages customer expectations, and makes sure that engineering development meets the specific needs outlined by the customer. With almost 20 years of energy efficiency industry experience, along with Dave Clark, Greg also is responsible for a seamless transition of customer vision into design excellence and installed reality. **Greg is directly responsible for the lighting controls integration for the Cities of Bethlehem, PA and Harrisburg, PA LED street lighting conversions, and will have primary responsibility for each PM's controls integration (if requested), as well as performance monitoring (Measurement & Verification).**

Eric Johnson, PE, CEM – Senior Energy Engineer. Eric has more than 20 years of experience delivering guaranteed energy saving projects with extensive experience in analyzing utility usage and performing energy audits. He has been a licensed Professional Engineer (PE) for the past nine years and a Certified Energy Manager (CEM) for the past eleven years. Eric's responsibilities on this project include the development and coordination of the project from a technical aspect, which will include determination of energy baseline, as well as assisting in the development of the M&V plan.

All project plans go through a final approval process with TEN's executive team:

Troy Geanopulos - CEO

Troy has founded and co-founded several energy efficiency companies over the past 20 years, including TEN. The foundation for each of these companies has been respect for customer and partner relationships and the ability to recognize and adjust to market trends. For Troy, perhaps the most exciting aspect of TEN is the company's ability to bring new technologies to the table in a way that will help customers improve their organizations. By doing so, he expects TEN to stimulate local economies nationwide and make a lasting positive impact on the environment. Troy has a BA from Dickinson College and has participated in the Entrepreneurial Leadership Forum through the Tepper School of Business at Carnegie Mellon University. He is very active in the Pittsburgh community, currently serving or having served on a number of non-profit boards.

Rob Campbell, PE, MBA - President

Rob is an energy efficiency expert, a proven-effective team leader with more than 25 years of energy efficiency industry experience. At TEN, Rob is responsible for all internal operations, systems, and processes. He provides oversight to the financial, engineering, information technology and construction teams. Before co-founding TEN, Rob was the Vice President of Constellation New Energy's Projects and Services Group. Rob is a licensed Professional Engineer and holds a BS in Mechanical Engineering from the University of Toronto and an MBA from Tepper School of Business at Carnegie Mellon University.

D. References

LED Street Lighting Upgrade Projects (over 2,000 Street Lights)

Bethlehem, PA (5,500 street lights)

In early 2015, TEN finalized the conversion of all of the cobra head street lighting in the City of Bethlehem, PA (5,500 fixtures) to LED technology, including the integration of a front-end controls system for Bethlehem to monitor energy usage and troubleshoot maintenance. TEN provided turnkey design-build services to Bethlehem, including performing a confirmatory audit as the project was being installed, as well as applying for and obtaining \$211,380 in rebates for the City, and submitting all documentation necessary for each fixture to be adjusted to a new rate class – all approved by the local utility (PPL Electric Utilities). Phase II of the Bethlehem project will consist of retrofitting several thousand decorative fixtures throughout the City to LED.

Baltimore, MD (7,000+ street lights)

TEN is currently in the process of converting the roadway and street lighting system in the City of Baltimore, MD (33,000 fixtures) to LED technology. In Baltimore, serving as the City's representative under a Design Assist-Construction Management contract, TEN is managing the installation of approximately 7,000 fixtures being installed initially in 17 high-crime areas designated by Baltimore personnel as their first priority in advance of converting the remaining 26,000 fixtures in subsequent phases.

Harrisburg, PA (6,000+ street lights)

In November of 2014, TEN was selected over 10 other companies (including a shortlist of Johnson Controls, Siemens, and Honeywell) by the City of Harrisburg, PA, to convert the City's approximately 6,000 street lighting fixtures to state-of-the-art LEDs - including the installation of a front-end controls package.

The Harrisburg project is currently in construction (approximately 1,300 fixtures were installed in December 2015 in 4 weeks), will be delivered by TEN to Harrisburg turn-key, and will take approximately 6 months to complete. Once complete, the City of Harrisburg program will include approximately 6,000 fixtures (4,000 cobra heads and 2,000 decorative luminaires). As part of the contract, TEN already has delivered to Harrisburg a comprehensive asset inventory audit of the City's entire street lighting system – also loaded into Harrisburg's GIS system – so that Harrisburg can LIVE TRACK the installation of the project as it is progressing. Over the next several months, all of the roadway and street lighting in Pennsylvania's state capital will be illuminated with LEDs, including a controls system capable of, at a minimum, dimming fixtures, troubleshooting maintenance, locating each fixture by GPS, and monitoring energy usage from a centralized location.

Detailed project descriptions for Bethlehem, PA, Baltimore, MD and Harrisburg, PA can be found below.

TEN Project Reference - City of Baltimore, Maryland LED Street Lighting Conversion

The **City of Baltimore** selected TEN to manage their latest street lighting conversion to LED, beginning with a Phase I asset inventory audit and conversion of approximately 7,000 fixtures to LED which are located in 17 high-crime zones designated by the City. Enhanced public safety/homeland security is the primary focus of Baltimore’s Phase I project. So much so, that the City asked TEN to evaluate and recommend fixtures best suited to “overdrive them” in these areas to shine a light on potential criminal activity – with the added feature to be able to dim the LED in the future if necessary.

Contact Information:
 Brent Hooper
 Street Lighting
 Superintendent
 City of Baltimore
 Department of Transportation
 (410) 396-1311 (office)
 (443) 324-6909 (mobile)

In Baltimore, TEN is serving as project manager, designer, fixture evaluator, and primary point of contact between Baltimore and the local project installer and fixture manufacturer. As part of the project, TEN completed and delivered an LED performance characteristics report to the City and, based on the report and consultation with TEN, Baltimore has selected the fixture (manufactured by Leotek) that is currently being installed.

Baltimore Before – HPS Cobra Head Luminaires



Baltimore After – LED Cobra Head Luminaires



TEN Project Reference - City of Bethlehem, Pennsylvania LED Street Lighting Conversion



The **City of Bethlehem** selected TEN to replace 5,400+ of the City’s existing High Pressure Sodium street lamp fixtures with 60% more efficient LED fixtures. TEN believes that this project represents the largest and most comprehensive city-wide LED street light conversion project completed to date in Pennsylvania, including pilot projects already completed in Philadelphia and Pittsburgh. TEN acted as project manager, designer and primary point of contact between Bethlehem and the local project installer and fixture manufacturer. Bethlehem chose Philips fixtures as the result of a highly competitive bid process facilitated by TEN.

Contact Information:
 Michael Alkhal, P.E.
 Director of Public Works & City Engineer
 City of Bethlehem
 610-865-7050
www.malkhal@bethlehem-pa-gov

Bethlehem chose Philips fixtures as the result of a highly competitive bid process facilitated by TEN.

Total Fixtures Replaced	5,500+
Funding Source	PNC (tax-exempt lease)
Installed Cost	\$3,804,093
Annual Cost Savings (yr.1)	\$472,579
Annual Electric Savings	2,042,262 kWh
Tons of CO2 Saved Annually	1441
Payback after Incentive (yrs.)	7.6 years
Contract Term (length of guarantee)	10 years
Rebate Incentive	\$211,380 (Act 129 PPL Electric Utilities)
Procurement Vehicle	PA Guaranteed Energy Savings Act (Act 39)

TEN requested a reference from the City of Bethlehem and here is what Mike Alkhal, P.E., Director of Public Works and City Engineer for the City of Bethlehem, had to say:

“TEN has played a significant role in implementing our City of Bethlehem lighting project with skill, professionalism, and energy. The professionalism in gaining an understanding of the requirements of the project, follow-up, and the coordination of existing contractors was outstanding.”

“Their professional approach to project management, responsiveness, coordination and communication along with the timeliness of output ensured that I would recommend TEN's projects team. It has been a pleasure working with them at all levels. Deadlines were met and communication, with the appropriate people, in both verbal and written form, was of high quality.”

“The project diligently addressed our community member’s concerns and emphasized public safety to the highest level. The aesthetic appearance of the Historic District was a high priority and TEN conscientiously worked with the historic district’s non-profit organization and the City to meet their needs, not only to meet their visual goals but to stay within the confines of the project budget.”

Michael Alkhal, P.E.
 City of Bethlehem

TEN Project Reference - City of Harrisburg, Pennsylvania LED Street Lighting Conversion

Recently, TEN was selected by the **City of Harrisburg** over 10 other companies (including a shortlist of Johnson Controls, Siemens, and Honeywell) to design and convert the City’s street lighting system to state-of-the-art LEDs. Once complete, the project will encompass over 6,000 fixtures, and will take about 6 months to install and commission.



All materials have been purchased by TEN, and TEN is currently constructing the project – with trucks on the street. TEN already has delivered to Harrisburg as part of the project a comprehensive asset inventory audit of the entire street lighting system, loaded onto Harrisburg’s GIS system. In several months, all of the roadway and street lighting in Pennsylvania’s state capital will be illuminated with LEDs, including a controls system capable of, at a minimum, dimming fixtures, troubleshooting maintenance, locating each fixture by GPS, and monitoring energy usage from a centralized location.

Contact Information:
 Wayne Martin, P.E.
 City Engineer
 City of Harrisburg
 717-315-4255
wsmartin@cityofhbg.com

Total Fixtures Replaced	6,127
Funding Source	M&T Bank (tax-exempt lease)
Installed Cost	\$3.57 million
Annual Cost Savings (yr.1)	\$510,333.00
Carbon Dioxide Removed from the Environment	5,736,872 Pounds
Simple Payback	7 years
Estimated Rebate Incentive	\$277,374
Procurement Vehicle	PA Guaranteed Energy Savings Act (Act 39)

As part of TEN’s audit in Harrisburg, the following data was collected in preparation of the conversion:

TEN Asset Inventory Audit Data Set for Harrisburg, Pennsylvania LED Street Lighting
All current streetlight fixtures
Luminaire styles and types
Wattages for all luminaires
Actual sample lighting levels of each luminaire type and of each roadway type (access road, two-lane, etc.)
GPS/GIS pole location of each asset
Current condition of pole and mast arms
Infrastructure issues related to poles and wiring
Infrastructure issues such as tree/limb obstruction or interference
Compliance with PennDOT lighting requirements
Values and averages for lighting levels and uniformity; and comparison to current lighting standards, IES recommendations and other City requirements

In Harrisburg, in addition to the Asset Inventory Audit, TEN is also undertaking an extensive historical analysis of utility billing for the streetlight system to determine any overcharges paid by Harrisburg to PPL Electric Utilities – known as TEN’s Overcharge Audit. To the extent that any overcharges are revealed, TEN will facilitate return of those payments to Harrisburg for as many years as permitted under applicable law.

Non Streetlight Retrofit Experience

When reviewing TEN’s project references, note that TEN’s team members, who are also assigned to this project, have been extensively involved with other LED lighting projects. One these projects, one example of which is described below, TEN’s team members performed the auditing, engineering, project development, selection and procurement of material and subcontractors through a competitive bidding process, contract negotiation, construction management (including onsite project management), commissioning, training customer staff, and delivering the measurement and verification of project performance.

**Penn State University, Beaver Stadium
LED Lighting Upgrade with Integrated Controls**

The significant element of this project was the timing. In order to be ready for the upcoming football season, TEN had to expedite delivery of materials and contractors' schedules. The Beaver Stadium project included the installation of a comprehensive LED lighting system upgrade with a wireless controls system - including exterior entry gates, concession walkway areas, loading docks, main concourses, ADA-accessible ramps, pedestrian ramps, and press stairways. All were completed in time for the first game of the season!



Total Fixtures	1,000
Installed Cost:	\$768,610
Annual Electric Cost Savings:	\$107,779
Total Annual Cost Savings:	\$139,779
Annual Electric Savings:	1,481,090 kWh
Annual O&M Savings:	\$32,000
Tons of CO2 Saved Annually:	1,021
Payback after Incentive (yrs):	4.9
Rebate Incentive:	\$76,776
Procurement Vehicle	PA Guaranteed Energy Savings Act (Act 39)

On-going or Contracted Street Lighting Projects

As noted previously, TEN is currently in the process of completing significant LED street lighting projects in the cities of Baltimore, Maryland and Harrisburg, Pennsylvania. In addition, TEN has been recently selected to convert approximately 900 street lights in the Borough of Middletown, PA.

In Baltimore, MD, TEN is serving as Lighting Designer and Construction Manager to oversee the installation of more than 7,000 fixtures (of 30,000) in the Phase I project. Upon completion, the City will realize hundreds of thousands of dollars in energy costs savings and have the ability of raising lighting levels to discourage crime in specific communities throughout Baltimore City.

In Harrisburg, PA, TEN already has provided the City with a comprehensive inventory audit and is now finalizing the installation of a state-of-the-art street lighting system complete with an asset management controls system. Harrisburg is expected to see at least **\$510,000 in energy cost savings** (guaranteed by TEN) in addition to significant **annual maintenance savings of at least \$65,000**. TEN is also conducting for the City a lookback audit to determine if they have been erroneously overcharged for electricity and poles by the local utility. Additionally, during installation, the Harrisburg community is able to track the success of the installation through an integrated **LIVE TRACK** GIS system – created by TEN.

In each of these programs, substantial energy savings is being leveraged to result in significantly reduced maintenance obligations, energy savings, enhanced public safety and an intelligent world-class street lighting platform ready to accept technologies of the future.

As part of the design of the PM projects, each may desire to add more poles or decorative fixtures to enhance light in certain areas – or to undertake strategic intersection street-scraping to not only enhance vehicular and pedestrian safety, but to enhance the aesthetic quality of an intersection.

As it relates to TEN's strength in assessing different product manufacturers for LED conversion, in the case of Baltimore and Harrisburg, as well as for Bethlehem, TEN facilitated the delivery of – in collaboration with the selected product manufacturers – extended 10-year product and maintenance warranties.

E. Approach

Designing a smart street lighting system for an entire city or municipality is no easy task. Each PM project will require a high level of coordination, expertise, specialization, and experience in order to deliver the desired result of new street lights (equipped with technology that will enable the installation of a controls system if desired), possible infrastructure improvements, and any smart city technology integration.

TEN has been a first mover nationally, helping cities of various sizes upgrade their street lighting systems. The team at TEN has done everything from developing a street lighting design to helping facilitate the procurement of materials to ensuring that all ideas are communicated with contractors and that our customers receive the absolute best prices in the marketplace. Because of TEN's turn-key role on numerous projects, **including the direct purchase of millions of dollars of street lighting and related lighting materials from the likes of Philips, Eaton/Cooper, GE, Leotek, Holophane (AEL), and CREE**, TEN has established substantial (and diplomatic) manufacturer relationships resulting in TEN's ability to analyze for our customers (and to deliver to them) the highest quality of commercialized lighting and smart city technologies, at the absolute lowest possible cost.

In order to meet the needs of each municipality, any contractor or manufacturer will require significant experience serving a municipality as well as being well versed in the latest smart lighting technologies. TEN is intimately familiar with the significant coordination needs of a street lighting project and TEN will design, develop and deliver to each PM the best possible project at the lowest cost – by driving down the costs of each project component (specifically labor and material), and leveraging economies of scale at every level.

General Scope Understanding, Project Goals, and Objectives

TEN believes that clear communication and meeting each PM's expectations every step of the way from the initial audit through the construction process are key components to successful project coordination and implementation. TEN will work closely with each PM to help prioritize and to ensure that the project is implemented on-schedule, as budgeted, and that the benefits of the project survive for the long term.

TEN will work with each PM to meet all goals related to design, product procurement, and installation, and TEN is committed to working with each PM, individually, to meet and exceed project goals:

- For All PM's: TEN will produce a final design plan that maximizes energy and cost savings, that improves standardization while reducing the variety needed for inventory, and that matches current needs and improves overall safety.
- For All PM's: TEN will produce an Audit Report that will provide the desired information to secure funding and/or to provide further economic justification for remaining project-related costs, including locating each asset by its GPS location – with 100% accuracy - rather than a 10-15 feet margin of error.

Procedure to Develop an Audit Report

TEN will review any current PM inventory audits and account billing summaries (actual bills) to perform a utility bill analysis to determine the exact existing quantities on which each PM is being billed, and the estimated wattage used to determine monthly costs to develop a baseline. The utility bill provides an explanation of terms and charges related to the supplier rate, generation and transmission rate in addition to noting any rate charges under the street lighting tariff.

In prior projects, TEN has used the municipalities' street lighting inventory and actual bill to develop estimated costs to deliver the audit reports, inventory assessment with utility bill reconciliation, financing assistance, system preliminary & final design, procurement of installation & maintenance contractor and installation management.

By extrapolating the "Total kWh" using "kWh per lamp" divided by the number of days in a billing cycle (typically 4,300 hours per year/12 – 358 hours/month tariff) as stated in PM's street lighting electric bill, TEN estimates the wattage that Central Maine Power uses to determine monthly costs based on kWh/lamp x number of lamps.

Referencing the hours per year that Central Maine Power uses and the estimated wattage for each luminaire, TEN then can determine the total yearly consumption. This analysis forms the basis for baseline energy consumption. Relying on TEN's past street lighting LED project experience, we know what the post wattages for each existing lamp type should be - therefore an estimate for savings is completed with an extremely high degree of confidence and certainty. Knowing the existing yearly consumption and estimated savings, TEN then performs an energy balance to determine and ensure our estimated savings projections are correct.

Each PM will then see, as a result of completing this project, a kWh reduction and a reduction in monthly utility bills.

Once the verification and finalization of TEN's Streetlight Inventory Assessment with Utility Bill Reconciliation is completed PM-wide, TEN will have an extremely accurate handle on existing quantities, wattages, conditions, and what will be required to finalize the design and installation plan. With a completed audit TEN can obtain accurate material and labor costs as well as post retrofit wattages – keeping in mind that some PM's may be currently paying for some street lights that no longer exist. The audit will facilitate accurate billing moving forward which will also represent direct utility cost reductions without the need for a corresponding retrofit cost. At the conclusion of installation, after all other utility negotiations are complete, TEN will also advocate for reimbursement of previous billing inaccuracies that are documented through this process.

Alternative Approach for Completion of Audit Report - Recommended

TEN's Alternative Approach for PM Projects

Instead of conducting the inventory audit/survey prior to installation, TEN proposes to undertake the verification survey/audit (with 100% accurate GIS level mapping) simultaneous with installation of the projects themselves.

Installed Faster = Getting Savings Faster.

Approach to the Project and Establishing the Amount to Be Financed

TEN believes it to be prudent to use each individual PM's current inventory audit spreadsheet (if available) in determining the project size knowing (as is always the case with audits) that they have a certain level of accuracy. Therefore, the final project size will then be represented in the form of a request for proposals for financing (issued by the PM with the assistance of TEN) in which we will indicate that the final amount may likely vary "slightly" as the project costs are refined and completed.

TEN then also recommends using a fully cost disclosed “add” / “deduct” approach to ensure and inform each PM of any discrepancies we experience in the audit as the installation of the project is completed. This has multiple benefits to each PM: i) reduces the redundant cost of providing a second audit immediately after the initial audit is complete; ii) shortens the delivery time of the project and allows TEN to begin installing the project on the individual PM’s timeline and when weather conditions are more favorable to more efficient installation; iii) protects the PM from incurring unnecessary costs knowing “upfront” what the costs are for any changes encountered during construction.

Utility Billing Structures Experience

Due to TEN’s contracts with the cities of Bethlehem and Harrisburg (both served by Pennsylvania Power and Light - PPL) and Baltimore (served by Baltimore Gas & Electric – BGE) for their LED streetlight conversion projects, TEN has become intimately familiar with utility street light billing structures. Furthermore, TEN’s work with the City of Baltimore requires TEN not only to design and project manage Baltimore’s LED streetlight conversion project, but specifically includes the technical analysis of Baltimore’s BGE utility billing structure, including utility bill reconciliation. TEN is confident that we will be able to provide this same comprehensive level of understanding, experience, and successes to each PM.

In addition, TEN has dedicated staff who previously held senior roles in the street lighting divisions of Northeast Utilities and Connecticut Light & Power. This expertise has facilitated repayment of utility overcharge refunds for municipal clients in CT and MA, most recently \$1.3 million to Springfield, MA.

Fundamentally, based on TEN’s significant experience and technical expertise, TEN will deliver to each PM a customized Audit Report showing costs, savings and payback (both simple and with any incentives included) for the LED streetlight retrofit. Again, there are few, if any, energy and utility situations TEN has not already encountered and successfully addressed for other street lighting clients - specifically including successfully applying for rebates, administering the process for, applying for, and obtaining confirmation of corrected billing for newly installed wattages from the utility, and obtaining refunds for overcharges related to street lights that no longer exist.

1. Audit

Asset Inventory Plan (Audit)

TEN will conduct a city-wide sample photometric field survey and audit, at street-level, delivered to the each PM sortable by street, neighborhood, district, and by roadway type (access road, two-lane, etc.). The audit will verify compliance with existing regulations and lighting standards, and will address over-lit or under-lit areas of each PM.

Data collected concerning over-lit areas and discrepancies in lighting uniformity or irregularities in lighting levels will be used in preparation for reducing installed wattages to optimize energy savings to benefit the economics and payback of each PM project, while at the same time delivering recommended light level standards.

The data associated with under-lit areas will be utilized to improve lighting levels in some areas to ensure public safety, security and proper visibility. For this purpose, TEN has a fully-engineered process and dedicated audit team (equipped with the latest photometric measuring equipment) to inventory the existing lighting levels; the result of which are accurate street-level field measurements. In addition to photometric results, TEN's inventory audit also gathers additional details and characteristics of the entire system.

TEN's analysis not only will completely and accurately identify and inventory all assets of the street lighting system, but also will be cross-checked against the latest inventory data (and actual bills) provided by the PM – if available – and uploaded onto TEN's audit platform, to reveal any discrepancies. This will allow TEN to correct the data at the field level, at the time it is discovered.

TEN's city-wide asset inventory audit, designed to facilitate a seamless transition to TEN's project lighting design and installation, can, where the PM finds value, capture electronically, each of the following:

Variables to Be Collected - Base Survey Information, including verification and GIS level mapping

1. All current streetlight fixtures;
2. Luminaire styles and types;
3. Wattages for all luminaires;
4. Actual lighting levels of each luminaire type;
5. Establish each pole's GPS location (with 100% accurate GPS location technology);
6. Cross reference with the PM's existing asset inventory and lighting level and wattage information to identify inconsistencies in lamp type and wattage uniformity;
7. Current condition of pole and mast arms;
8. Notation (comments and/or photos) of visual infrastructure issues related to poles and wiring or tree/limb obstruction or interference;
9. Confirmation of ownership and maintenance for each luminaire and pole;
10. Compliance with state roadway lighting requirements (where necessary);



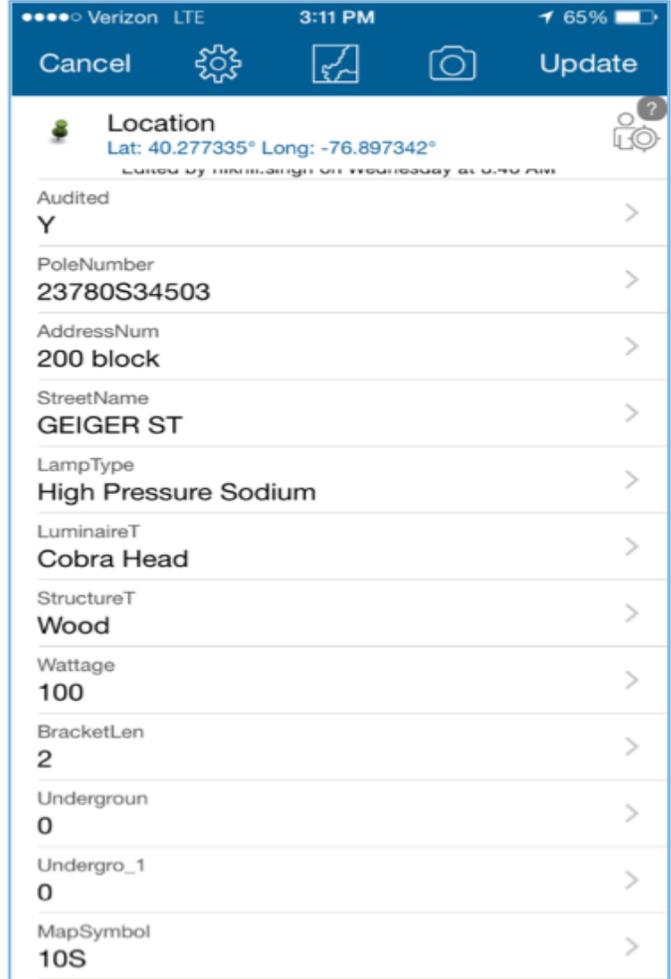
Optional:

11. Roadway widths;
12. Discrepancies or irregularities in lighting levels;
13. Pole height of each asset;
14. Values and averages for lighting levels and uniformity; and compare them to current lighting standards, IES recommendations and any other specific PM requirements.

TEN will collaborate with the PM's through a final scoping analysis of the audit. Additionally, daily or weekly status reports will be made available through a GIS LIVE TRACK system for each location to track the progress of the audits. Using our mobile-based inventory audit program, each individual PM will be able to access audit updates on the progress of the inventory assessment.



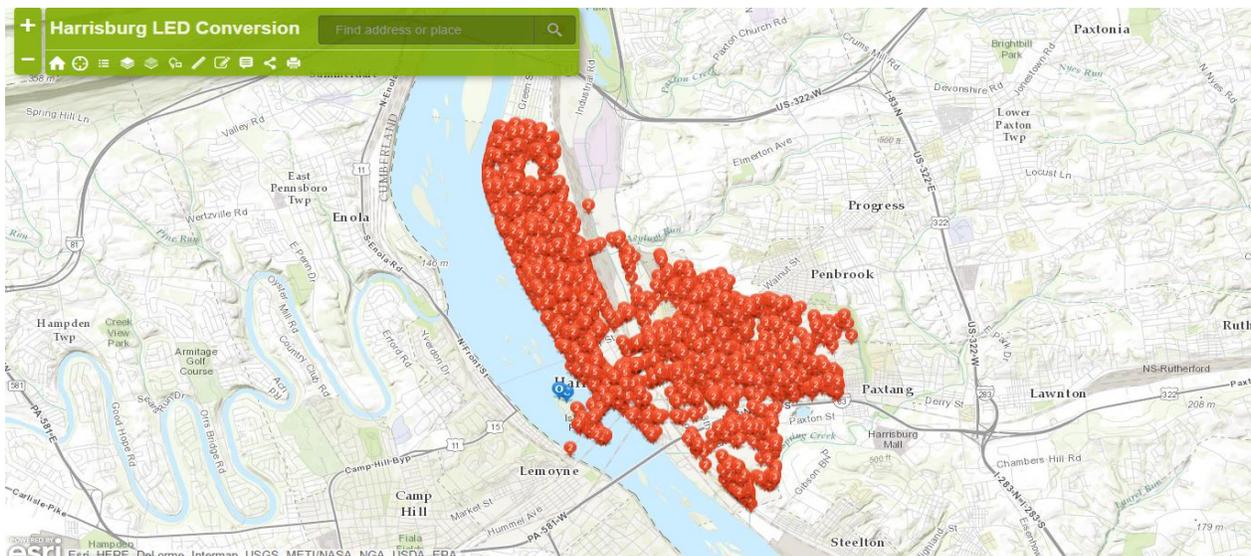
Following is a sample depiction of the system that would be used in each of the PM's daily or weekly audit reports provided through TEN's mobile-based audit platform.



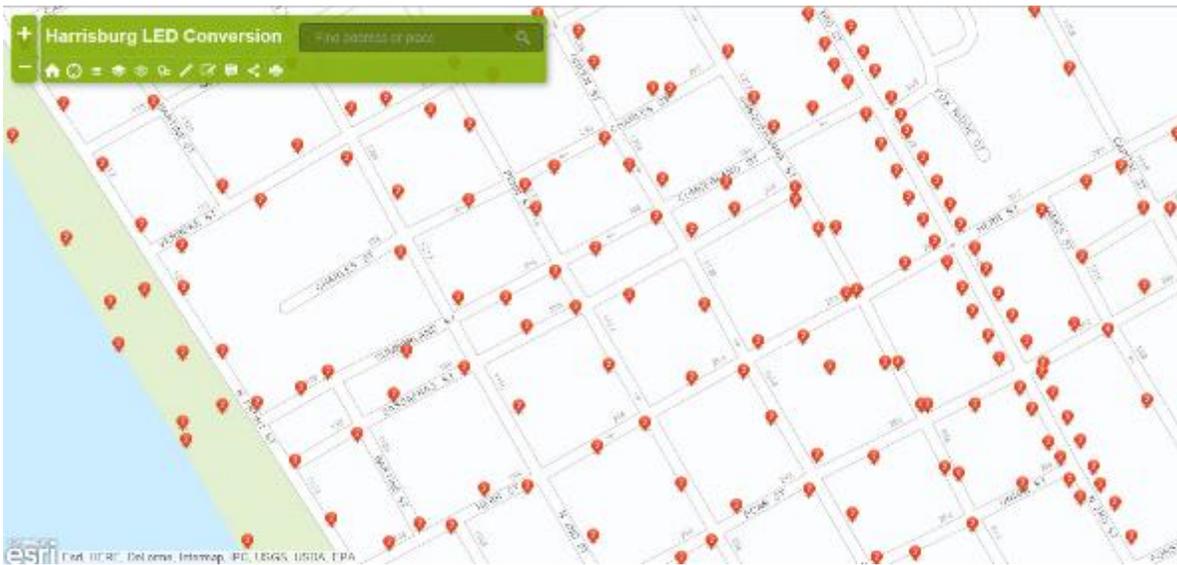
Below is screen shot depicting TEN’s GIS/GPS progress mapping of the asset inventory audit for Harrisburg, PA. At the time this screen shot of the GIS system was taken, approximately 90% of the asset inventory audit was complete (red sections had not been audited). As TEN has completed the conversion of the street lighting system, TEN has supplied **real-time LIVE TRACKING** updates to its platform to inform all stakeholders, real-time, as each new LED is installed.



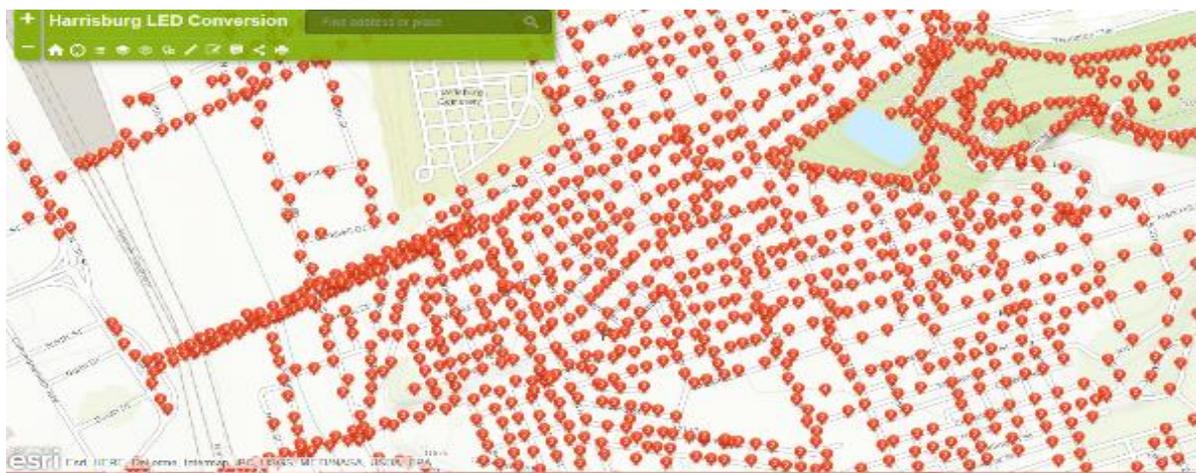
Progress Mapping – Pre LIVE TRACKING – Visual 1



Progress Mapping – Pre LIVE TRACKING – Visual 2



Progress Mapping – Pre LIVE TRACKING – Visual 3



For the Asset Inventory Audit, TEN’s highly trained project manager and efficiency agents will work with locally hired audit team members (and provide rigorous training on TEN’s developed platform over a few day period) to complete the inventory assessment for each PM. For example, in Harrisburg, TEN hired local Harrisburg residents, who received extensive training on TEN’s auditing platform – to work alongside TEN’s team to complete the audit of the lighting system and to assist in the final lighting design to be installed – resulting in an very successful locally-supported accurate audit. TEN believes a similar approach would be ideal for each PM.

Maintenance capabilities

For each of its customers, TEN delivers a custom Operations and Maintenance (O&M) manual for luminaires and controls systems. Minimal maintenance is required considering 20-year fixture life and extremely low failure rates of LEDs (i.e. less than 1% in TEN’s experience). The development of the maintenance plan starts during the Audit phase of the project. TEN carefully evaluates operating procedures and characteristics so that the luminaires, controls, and ancillary equipment have the most appropriate maintenance plan. TEN’s maintenance analysis process yields benefits because the systems can then be operated at the highest level of efficiency.



2. Financial Stability

TEN is well qualified to provide each PM with custom financing options for funding 100% of each project. Because the economic and financial structure of each project is just as important as the technical aspects, the proven financial capabilities of our team will result in the lowest possible cost financing options available at the time of financing.

Our team’s experience in creating project financing for municipal customers over the past few decades will enable TEN to assist each PM in meeting its internal financial requirements. Financing structures can vary based upon the types of equipment and systems to be installed, the available savings to be leveraged, and the type of accounting recognition and treatment requested by each PM. TEN will customize the terms of our contract with each individual PM’s project financing goals to ensure that they each receive the absolute lowest cost financing.

TEN is significantly experienced with managing, quickly and efficiently (within days), an internal RFP process for our customers to “open the financing up to competition” so that our customers receive the absolute most competitive rates and terms possible.

TEN does not have any monetary interest in financing the project, nor will TEN receive any commissions related to a financed project should TEN introduce the City to an eventual funding source.

Tax-Exempt Lease Purchase Option (Recommended)

A third-party funded tax-exempt lease is a common method of funding energy savings performance contracts (ESPCs). The tax-exempt lease structure generally offers the advantage of quick availability of funding, low issuance costs and flexible payment terms that can match up to the savings cash flow.

“Shared Savings” / “Sale Leaseback” and Power Purchase Agreement (PPA) Models

(Not Recommended)

TEN does not recommend that any of the PM’s enter into a system acquisition agreement whereby an independent third party (not the PM) purchases the street lighting system from the PM (or on their behalf) and then leases the system back to the PM. This “Shared Savings” funding model in the end can be unnecessarily costly and is generally reserved for non-government organizations that do not have access to extremely low-cost tax-exempt financing.

The shared savings model is materially flawed (and has been out of favor for many years) because PM's can obtain financing dollars to invest in the project much cheaper than a third party can loan it to them. In some cases, these "solutions" come with a hefty 10% or more cost of capital interest rate built in to support the internal rate of return (IRR) requirements of the lender – making it absolutely necessary for that lender to "share" the savings with the PM to cover the higher costs. Additionally, with historically low tax-exempt interest rates available, a PM should not share the energy savings dollars with a third party when the most economically prudent course of action should be for the PM to retain all of the energy savings to support the conversion – resulting in more scope for the available savings when compared to the shared savings model.

3. Design

There are important aesthetic, performance, operational, and ethical decisions that must be made when deciding on the street lighting package and installation configuration. These include determining the lighting levels required to accomplish the objectives; balancing the cost, energy efficiency, public safety, maintenance regime, and life cycle of the product chosen; choosing a fixture and pole style; addressing sky glow and light trespass through cut-off options; consideration of control systems; deciding on a light curfew (if appropriate); deciding on pole height and spacing; and evaluating the effect of lighting on nearby ecological habitats, such as parks, greenways, and riparian corridors. We discuss a few of these items for consideration in detail within this section, because important design decisions are informed by these considerations and the quality of the field audit.

The main goal of a TEN-converted streetlight system is to ensure that safety, security and visibility are maintained throughout each PM by ensuring appropriate lighting levels. At the same time, the volatility of electricity markets, how electricity is priced into the market and, the seemingly inevitable rise in electricity prices, require TEN to focus directly on reducing excess energy consumption wherever possible.

In addition to the goal of improving safety, security and visibility for residents, motorists, cyclists and pedestrians, TEN's inventory audit will detail and verify lighting levels and discrepancies in uniformity of existing installations, and will identify any areas requiring corrective action to ensure that, municipality-wide, the lighting system, designed and installed by TEN, will be consistent with nationally recommended lighting level standards post-conversion.

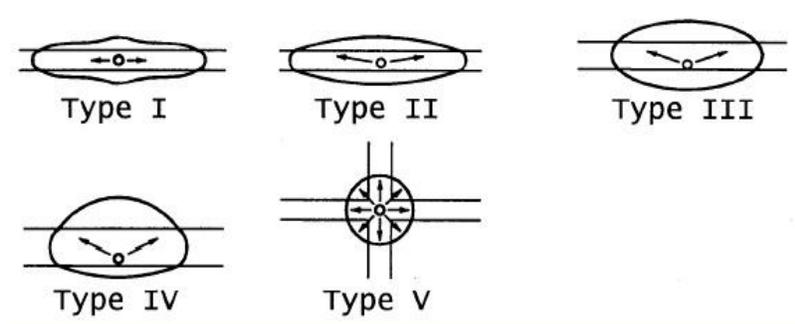
Importantly, TEN shares PM's perspective that, although IES RP-8-14 recommends adequate light levels for the safety of pedestrians, cyclists, and vehicles, existing pole placements limit the degree to which IES standards can be met. Therefore, TEN has independently developed design methodologies that will best deliver adequate lighting for each PM for the expected product life cycle while at the same time supporting each PM's specific goals associated with customized lighting levels. And therefore, IES standards may not be the standard selected by a particular PM.

For example, enhanced public safety/homeland security is the primary focus of the City of Baltimore's Phase I LED conversion project. So much so, that the City asked TEN to evaluate fixtures best suited to "overdrive them" in high crime areas to shine a light on potential criminal activity – with the added feature to be able to dim the LED in the future if necessary to preserve its life cycle. TEN's customized design methodologies (based on life cycle costs and fixture performance analyses), after having been fully understood by Baltimore, were used by Baltimore to make its final selection on fixtures.

Appropriate Lighting – Pedestrian and Bicycle Crash Data, Localized Land Uses, Volumes of Bicycle Activity, Unique Neighborhood Activities.

In the City of Harrisburg, PA, TEN was also asked to identify areas where lighting could be increased – public safety corridors, parking enforcement zones, and high crime locations, and then to recommend the most appropriate light levels and technology to meet those specific goals. TEN’s design methodologies and recommendations were utilized by Harrisburg to inform their final fixture selection decision.

Different luminaire types can produce different lighting distribution. TEN will work with each PM to incorporate an appropriate analysis of important data points that can be used when developing the final lighting retrofit design. For example, this may include using a specific distribution footprint and light output for bicycle paths and high traffic locations coupled with pedestrian proximity, as well as analysis of the specific lighting distribution types, as follows:



Additionally, once TEN has obtained the specific pedestrian/vehicle and bicycle/vehicle crash data from each PM, our team will evaluate options available to each PM and TEN will make recommendations regarding appropriate changes to light levels in specific locations throughout the PM.

Addressing Placemaking and Wayfinding – Benefits Residents, Visitors, and Businesses

When it comes to street lighting specifically, there are many opportunities for contributing to the aesthetic quality of a street. Using intelligent luminaires with a controls system, the intensity of street lights can be adjusted to not only save energy but also to highlight certain streets and provide cues to people that a particular street is residential (less bright) or commercial (brighter). Intensity of light can also be moderated to indicate activity during special events. A further use of intensity is to provide illumination for emergency or evacuation situations.

It is also important to limit the amount of light that trespasses onto adjacent buildings for a number of reasons. Light trespass can be a serious annoyance for residents whose interior space is affected by street lights with insufficient cut-off. Light trespassing on a building may also interfere with a property owner’s attempts to control the nighttime aesthetics of their building via their own architectural lighting scheme.

Another factor is the surrounding reflective value of materials, such as sidewalks, and weather conditions, particularly rain and snow. Reflective surfaces impact luminance, increasing available light by up to three times. When sensors and control systems are in place, lights can be dimmed accordingly to optimize performance and minimize the cost of operation.

When glare and light trespass are due to fixture design, they can be solved through the use of reflectors and shields on luminaire heads to shield or diffuse excess light. In general, when considering LEDs, a color temperature of 4,100K or warmer is recommended.

Addressing Safety – Benefits Residents, Visitors, Public Safety Officials, and Businesses

A major task of street lighting is to increase safety for motorists, pedestrians and bicyclists, particularly at intersections where pedestrians/bicyclists may be crossing. A consistent concern is that high-mast streetlights, particularly those garnished with High Pressure Sodium (HPS) bulbs, do not adequately provide contrast between the pedestrian/ bicyclists and the background.

Metal halide fixtures have long been used at intersections because their better color rendering allows for better visibility and contrast. LEDs provide a similar benefit in this application. Street lighting also has an impact on the ability of emergency and utility personnel to perform their work at night. Emergency personnel report having a hard time seeing color properly under HPS lighting. This is an issue when work crews must identify colored electrical wires, for example.

Another safety consideration is the effect of street lighting schemes on closed-circuit television (CCTV) systems. Many cities have installed CCTV cameras throughout the City for various purposes, including crime monitoring and homeland security. Cameras are located on buildings, light poles, and utility poles.

LED lighting, with its potential for bright light and glare, needs to be designed to be compatible with the camera performance. In some cases, cameras may also need to be repositioned for enhanced views. Safety officials generally prefer uniform light along the street, believing that uniform light eliminates shadows and adds to clarity. And LEDs improve the results of facial recognition technology.

Nighttime lighting also provides psychological comfort for society’s more vulnerable members. When designed properly, lighting can be an effective tool in promoting outdoor safety. Crime Prevention Through Environmental Design (CPTED) researchers recommend that outdoor lighting be used to help with “natural surveillance” and “natural territorial enforcement” strategies.

Specific tactics include:

- Avoid poorly placed lights that create blind-spots for potential observers and miss critical areas
- Ensure potential problem areas, such as stairs, entrances and exits, ATMs, bus stops, dumpster and recycling areas, are well-lit (but not overly lit)
- Use shielded or cut-off luminaires to control glare
- In pedestrian areas, place lighting at heights that will illuminate the faces of the people
- Use lighting to identify property ownership and define public, private, and semi-private space



Addressing Operational Considerations (life cycle cost) – Benefits Residents, Visitors, Local Government, and Businesses

When the full life-cycle of a lighting fixture is considered, LED technology has been found to be the least costly and least environmentally harmful lighting source available.

Addressing Energy Use – Benefits Residents, Visitors, Environment, and Businesses

LED technology's low-energy profile can further be enhanced by the use of control systems and sensor programs that allow for user-control of street lights in certain contexts. Luminaire light output may also be reduced when there is sufficient natural ambient light.

LED lighting is increasingly emerging as a way to capture energy efficiency savings around the world. There are more than 131 million street lights in the United States alone, producing 128 million metric tons of carbon dioxide pollution annually. Ninety percent of these lights are HPS. Approximately one to two percent are LEDs.

A comparative life cycle assessment of available street light technologies by the University of Pittsburgh's Mascaro Center for Sustainable Innovation noted the following

- 22% of all energy generated in the U.S. is used for lighting, with 8% of that used for public outdoor lighting.
- 90% of power used for light bulbs produces heat, not light.
- LEDs are the most efficient, durable, long lasting and environmentally clean lighting source to date.
- LEDs typically last 10-12 years, and potentially upwards of 20 years, significantly reducing maintenance costs, waste and environmental impact.

According to the US Department of Energy, in the next 20 years rapid adoption of LED lighting in the U.S. can:

- Reduce electricity demand for lighting by one-third
- Eliminate 258 million metric tons of carbon emissions
- Avoid building 40 new power plants
- Create financial savings that exceed \$200 billion

Generally, Post Field Survey Efforts produce the following data which TEN would analyze, review and provide to the City: (1) Manufacturer Selection, (2) Final Design, (3) Installation Plan Base on Field Survey, and (4) Energy Analysis.

Addressing Monitoring – Benefits Residents, Visitors, Public Safety Officials, and Businesses

Since LED lighting is electronic, it can be remotely controlled or addressed on an individual fixture basis, on a series basis such as a particular street, on a City-wide basis, or any combination. Control methods include sending electronic signals by radio frequency (RF), internet (Wi-Fi), cellular, or simply by hard wiring. Safety officials feel the control possibilities of LED street lighting offer a variety of communication methods to alert fire and police. For example, the fixture closest to a 911 incident may flash on-and-off. Light intensity can also be increased to provide additional light when needed. Controls can be used to identify each street light's location to measure power usage on an individual basis, to signal when replacement is needed, to identify burned out or damaged fixtures, or to adjust color temperatures to accentuate warmer or cooler hues.

Addressing Durability – Benefits Local Government

AASHTO provides standards for the durability of luminaires in general. As a solid-state (SSL) technology, LED arrays are more able to hold up to shocks and vibrations.

Addressing Reliability – Benefits Local Government

Storm events knock out street lights and traffic signals, requiring Public Safety to assign police officers to critical intersections on a 24/7 basis for at least 24 hours and occasionally longer to direct traffic. At critical locations, backup batteries can be used for LED fixtures.

Addressing Light Output – Benefits Residents, Visitors, Public Safety Officials, and Businesses

Emergency responders require street lighting to be bright enough for emergency situations. While street lighting will need to meet minimum Lighting Ordinance footcandle standards, the amount of light may not be enough under certain emergency circumstances. The ability to increase LED light output at intersections via addressable controls is an advantage of the technology.

Addressing Light Pollution – Benefits Residents, Visitors, and Businesses

Light pollution is possibly the easiest form of pollution to prevent since it is easily controlled through proper fixture design. Additionally, much of it, such as street lights, is directly under the control of the public sector or is subject to regulations.

Addressing System Control Types for Consideration:

- Wireless Mesh provides reliable connection between controllers and gateways
- Wireless Star also provides reliable connection between controllers and gateways
- Utility grade metering measures energy savings accurately
- GPS positioning provides node self-commissioning, at the pole, in minutes (TEN Recommended approach during simultaneous audit & installation)
- Photocontrol turns unit on at dusk, off at dawn
- Programmable dimming options provide for even greater savings and control
 - 10%-90% options in 10% increments
 - Select hours to apply dimming and store schedules in node
 - Life compensation dimming provides an additional 7.5% energy savings
- Manual control is always available
- Software manages system in real time and keeps full energy use and control action histories
 - Hosted on customer server, M2M capability and high level of security encryption
- User defined diagnostics automatically register system failures, load failures, power outside range, turn on failure, field outages and line voltage changes

4. Project Management

TEN's experienced in-house project managers will utilize our automated platform to update each PM on project success, in addition to regularly scheduled in-person progress meetings. Starting in the design phase, and continuing through the implementation phase, TEN will develop our partnership approach with each PM to identify the personnel required to efficiently execute the project. Once all of the members of the project team are identified, the expectations for the project and its implementation will be clearly outlined. The project's implementation milestones will be established in the contract and in

more detail in the project's construction meetings. These milestones will be confirmed regularly through clear lines of communication which have been established to facilitate a successful project implementation.

TEN believes that clear communication and meeting the each PM's expectations every step of the way through the construction process is key to successful project coordination and implementation. TEN will partner with the each PM to help prioritize and to ensure that the project is implemented on-schedule, as budgeted and that the benefits of this program survives for the long term.



When TEN is invited to assist in optimizing equipment selection and system design, our team goal is purely to serve the Municipalities with a high quality project implementation which saves operating costs (energy and maintenance) while delivering a street lighting system providing optimal comfort and safety, and other required environmental conditions. TEN's Senior Solutions Team researches, designs, and oversees field installations and testing of the high-quality, cost-effective lighting measures along with various other energy saving and capital improvement measures. **TEN will assist each PM in analyzing the efficiency and characteristics of several world-class LED cobra-head fixtures for possible selection.** TEN's independence from any particular manufacturer enables us to provide the Municipalities with the most appropriate lighting solutions that efficiently address specific needs – further enhancing our partnership. TEN's engineers and lighting designers have been able to diplomatically work with product manufacturers and suppliers to help in the selection of equipment and systems that can deliver a lower life cycle cost and controls sequences.

Implementation

The major general steps of a TEN construction implementation plan are as follows:

Initial Project Startup

Immediately upon award of the project, TEN will further develop the partnership strategy with the Municipalities and identify all of the personnel required to efficiently execute this project. Once all the members of the project team are finalized, the expectations for the project and its implementation will be clearly outlined. The project's implementation milestones will be established in the contract and in more detail in the project's regular construction meetings. These milestones will be confirmed regularly through clear lines of communication which have been established to facilitate a successful project implementation.

Procurement

As each project submittal is approved by the PM, purchase orders will be issued for materials and subcontracts entered into for installation. TEN will carefully evaluate the pre-identified subcontractors to determine the most appropriate fit for the project scope. TEN's independence from any particular subcontractor or manufacturer ensures that it is able to provide the most appropriate solutions that efficiently address the PM's needs. As a result, TEN can develop an objective and unbiased partnership with each PM by implementing the lighting equipment and system upgrades that generate maximum returns.

FOUR CRITICAL STEPS that TEN has identified in the project implementation phase, that require precise record-keeping, and that are handled directly by TEN’s Project Manager as follows:

1. MONTHLY Utility Notification of work complete - Allows savings to be “activated” on a monthly basis
2. MONTHLY Rebate Notification of work complete - Keeps a steady rebate cash flow returning to customer
3. MONTHLY Customer Invoicing of work complete - Systematically spaces project costs to customer
4. MONTHLY Subcontractor Invoicing of work complete - Provides cash flow for equipment and miscellaneous costs

Construction

Regular meetings will be held with the Municipalities to establish construction guidelines and TEN will work with the PM’s to minimize the impact of the construction activities. Standard project management tools, such as a Gantt chart will be used to track progress. TEN prides itself on a proven track record of successful project implementations in varied settings which include everything from installations in offices, classrooms, gymnasiums and major sports stadiums, to special access situations in correctional and medical facilities – **and certainly street lighting projects where traffic and pedestrian safety is of critical importance.**

Construction services will be sourced through mutually agreed upon specialty electrical and controls subcontractors. All subcontractors perform their work under the direction of our in-house construction project management. TEN’s local construction project managers will collaborate with our internal engineering team on specific design issues which are certain to arise. TEN’s internal project management team also will be responsible for training, preparing custom Operations & Maintenance (O&M) manuals, and overseeing project commissioning.

Inspections & Reporting

As part of our Quality Control program, continuous inspections during construction are performed to ensure compliance with the scope of work and any PM requirements. TEN’s project managers and engineers along with the PM’s representatives will inspect the construction of the project. Progress will be tracked on a daily and bi-weekly basis, and the results shared with the Municipalities and the Project Team.

Project Commissioning Plan

In the street lighting industry, the term “commissioning” is often applied to lighting control system activation, and applies to the entire PM and its energy-using systems, including luminaires and controls. System activation and functional testing are steps within a larger process of ensuring all installed systems satisfy the design intent and owner requirements.

Commissioning answers the question, “Does the lighting system perform according to what the owner wanted and the designer intended?”

Using a Global Positioning System (“GPS”) embedded into each fixture, the street lights are able to identify themselves and network instantly (“real time”). This approach reduces the cost of programming each fixture and eliminates on-site commissioning.

If the Municipalities' street lighting configuration resides on its Geographic Information System ("GIS"), various types of lights including traffic signals, decorative, park lights, and various types of decorative lighting can be combined with the existing street lights ("layered GIS").

Measurement and Verification (M&V) Approach

Energy savings for an LED street lighting upgrade project is determined by comparing annual energy use before and after the installation of the upgraded technology. The objectives of the M&V process are to document the annual energy savings achieved by the project. Energy use patterns are studied before and after the installation, and the annual energy savings are calculated as the difference between energy use before and after implementation (base-year and post-retrofit energy use). The calculation of energy savings may require adjustments to hours of operation if adjustments are permitted by the Municipalities utility.

TEN will provide a guaranteed savings program to the Municipalities based upon sound and proven engineering design principles that: 1) isolate the energy efficiency criteria for which TEN is responsible, and 2) specify those other parameters which are beyond TEN's control.

TEN will provide a customized M&V plan in accordance with the International Performance Measurement Verification Protocol (IPMVP). Our lengthy experience with all IPMVP options (A, B, C and D) enables us to delineate the cost and benefits of the approach needed to ensure the optimal structure of the M&V plan for the PM. As a means of equipment verification, the selected control system can act as a check and balance to verify the upgraded equipment is performing as the manufacturer intended.

Project Acceptance

TEN's Project Manager will work in conjunction with the Municipalities' personnel to make sure all systems, fixtures and equipment are performing as designed. Any deficiencies will be identified as punch list items and will be used to track and correct the deficiencies. Once the PM and Project Manager have signed off on the completion of the Project, it is turned over to the Municipalities' street lighting operations personnel.

The Project Acceptance date marks the start of the material workmanship warranties from the manufacturer, and the savings measurement period.

In addition, a functional customized Operations and Maintenance (O&M) Manual will be provided to help optimize operation in order to provide significant energy savings and other lighting upgrade-related benefits. TEN views its O&M Manual as a risk reduction strategy, which will help systems run efficiently, function properly, and deliver its full life expectancy.

Operation & Maintenance Plan:

TEN's partnership approach continues throughout the contract term after the project's implementation to ensure that the savings guarantee and equipment operating parameters are realized. The warranties will be well-documented in the project-specific operating manuals and TEN stands ready to assist the Municipalities on any warranty issues. TEN's approach to cost-effective maintenance of the project is to train PM staff whenever possible, to understand and address operation and maintenance issues.

In order to guarantee efficient functioning of all installed equipment, and the energy management goals of the PM, a customized preventive operations and maintenance plan (PM Plan) will be delivered by TEN

after project completion.

The PM Plan would consist of a checklist of tasks that are performed at manufacturer-recommended intervals (usually measured in hours of equipment run time). This checklist will be kept in a form of a log and updated manually when tasks are performed. The PM Plan would include the following fundamental information, gathered during the audit:

- Installed Equipment;
- Manufacturer's name;
- Vendor's name and contact information;
- Date installed;
- Warranty information;
- Recommended Parts Lists;
- Vendor Maintenance;
- City of Scranton Maintenance;
- Maintenance Checklist;
- Training;
- City-wide lighting and lighting controls Layouts and As Built Lighting and Lighting Controls Layouts.

In general, a comprehensive maintenance program should include:

- Fail alert system details
- Luminaire cleaning plan (Less heat is generated on lenses by LEDs than HID lamps so less dust normally adheres and fuses to the lens than historically with outdoor luminaires)
- Unit, power supply and photocontrol replacement plans (Note that today's power supplies are rated for 100,000 hour life and the expectation is that **replacements will be very rare (<1%)**).

Training

Training is an important aspect of TEN's offering. PM personnel need to understand the objectives of the energy savings program and equipment operation to meet those objectives. To that end, comprehensive training is usually held on-site, during the construction phase to familiarize the staff with the new systems. The majority of training is focused on familiarizing personnel with the new lighting and controls equipment being installed, equipment / system operation and regular maintenance. Most of the training will take place during start-up of the equipment and the commissioning process, and some at project completion. All training is coordinated by TEN project managers and the operations representative from the PM.

Integration with the Municipalities' GIS System, if available

Unique to our offering, we believe, is our ability to provide the Municipalities with electronic GIS shapefile format files that we create through our integrated, mobile-application driven auditing process and commissioning during our structured installation process. This enables the Municipalities to integrate all of the new street lighting information (i.e. technology, inventory, wattages, GPS locations, etc.) into their existing Global Information System (GIS) at the time of installation. This is incredibly helpful to the Municipalities in managing its street lighting system, providing analytics, and ensuring quick response times to outages.

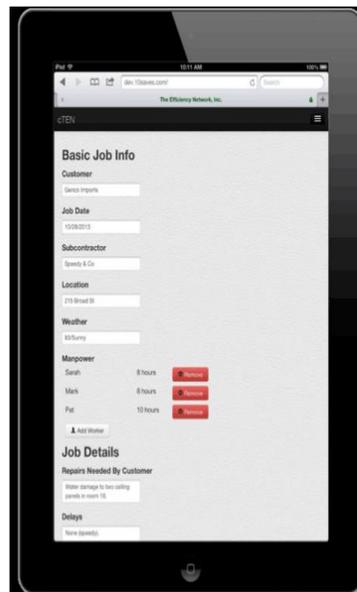
When difficult and complicated challenges arise, TEN's broad expertise and street lighting specialization will enable studying the problem, exploring all possible solutions, and supplying the PM with clearly defined options along with a recommended course of action.

Quality Control

TEN believes that quality control starts in the development stage and continues all the way through construction and measurement and verification. An effective energy savings program requires a delicate balance between engineering and construction management. We establish this balance by involving the construction team during the development phase of the project to ensure the constructability of the lighting and lighting controls solutions we propose. The ultimate success of any energy savings project is measured by the ability of the installed systems to achieve the projected savings targets and to meet environmental expectations, while the success of a brilliant design is predicated by its ability to be constructed. TEN takes a comprehensive approach to development and engineering to establish this critical balance. This approach is possible because TEN utilizes in-house design, engineering and construction management.

Our design, engineering and construction teams work closely with each other to develop the scopes of work that are competitively bid to the Municipalities' qualified vendors and contractors to ensure that the design intent is met, the project/system can be installed properly and maintained, and the construction team is very familiar with the project before installation begins. This seamless and transparent hand-off to construction ensures quality control. TEN's team is also open to our subcontractors' input when it improves the design and/or lowers the cost to provide a better solution for the Municipalities.

Reporting to TEN's Director of Construction, the on-site 30-hour OSHA Certified Project Manager is accountable for the management of all assigned project construction activities taking place. The Project Manager (PM), through their on-site management, will ensure that the worksite is safe, supervised and managed in an effective and efficient manner for the Municipalities. Maintaining and managing daily communications with and directing the activities of all subcontractors is key to the success of the project. Our project managers utilize TEN's proprietary cTEN application to



quickly and efficiently report worksite progress, concerns and work scheduled to be performed the following day. *This communication (depicted below) is shared with both our Director of Construction and designated personnel of the Municipalities as another procedure to monitor quality control.*

Warranty and Maintenance

A comprehensive, 10-year material warranty will be included with TEN's project offering for the Municipalities. The manufacturer's warranty will pass through TEN directly to the Municipalities to ensure that they will have direct access to the full value of the manufacturers' warranty over the term of the contract. Specifics of this warranty will be detailed in writing through the final engineering process with the selected manufacturer(s).

5. Technology Procurement

a. Fixtures

TEN appreciates the desire to upgrade street lighting throughout the individual PMs to achieve the maximum benefits of LED technology while also maintaining a high level of value through the use of quality products and careful installation. TEN's unique approach to street lighting solutions will aid the Awarding Authorities in determining the best lighting fixture(s) that meets their needs. On a weekly basis, TEN is working with the worlds' leading exterior LED streetlight and decorative fixture luminaire manufacturers and distributors, and incorporating their technologies into our projects. This position allows TEN to be an early evaluator of these technologies, and to come to conclusions regarding the efficiency, design, light output, quality and characteristics of them.

There are important aesthetic, performance, operational, and ethical decisions that must be made when deciding on the street lighting package and installation configuration. These include determining the lighting levels required to accomplish the objectives; balancing the cost, energy efficiency, public safety, maintenance regime, and life cycle of the product chosen; choosing a fixture and maybe a pole style; addressing sky glow and light trespass through cut-off options; consideration of control systems node or photocell; deciding on a light curfew (if appropriate); deciding on pole height and spacing; and evaluating the effect of lighting on nearby ecological habitats, such as parks, greenways, and riparian corridors.

The main goal of a TEN-converted streetlight system is to ensure that safety, security and visibility are maintained throughout the individual PM by ensuring appropriate lighting levels. At the same time, the volatility of electricity markets, how electricity is priced into the market and, the seemingly inevitable rise in electricity prices, require TEN to focus directly on reducing excess energy consumption wherever possible.

As part of TEN's competitive evaluation process on behalf of each PM, TEN will provide each with a customized **LED Fixture Performance Characteristics Matrix** to facilitate discussions between TEN and the PM with the end goal of assisting in the internal evaluation and final fixture selection.

Following is a depiction of TEN's Performance Characteristics Matrix that was under discussion between TEN and the City of Harrisburg prior to fixture selection. This chart served as the foundation for TEN, on behalf of Harrisburg, to request (in this case) cobra head fixture pricing – as well as to offer recommendations to Harrisburg regarding final selection.

Sample TEN Performance Characteristics Matrix to Facilitate Final Fixture Selection

Harrisburg Street Lighting

Manufacture	GE	LEOTEK ELECTRONICS USA LLC	CREE	Cooper	HOLOPHANE / AEL
Part #	ERS10B3E1140AGRAYB DT	GCM1-30F-MV-NW-3-GY-1A-PCR7	BXSPCHT2MEE40K-ULSVN- SPX	VERD-A02-D-U-T3-4N7- 10K-4B-AP	ATBM E MVOLT R3 4B MP AO
Watts	117	105	101	92	115
Color Temp	4000k	4000k	4000K	4000k	4000k
CRI	70 CRI	70	70	>70	70+
Distribution	TYPE III	3	II LONG, II OR III	T3	R3
Lumens	9300	9,192	8,407	9,099	13,600
mA	1050mA	1000	375mA/4	1.6ma	950mla
lm/W	79	88	83	99	118
IP Rating	IP66	66	IP66	IP66	IP66
Life Rating	50,000	100,000	100,000	>254,000	100,000 system
EPA ft2	0.5	0.44	0.7	0.5	.70
BUG Rating	B1-U0-G1	B2 U0 G2	B1 U0 G1	B2 U0 G2	B2 U0 G3
DLC (Y or N)	Y	Y	Y	Y	Pending
Weight #	20 lbs	10 lbs	<18LBS	20 lbs	21
7 pin NEMA PCR	7 pin included	Y	7 pin included	7 pin included	7 pin included
Lead time	2-4 weeks	2-3 weeks typical.	4-6 WEEKS	2-4 weeks	3-5 WEEKS
Dimming	0-10V driver Included	0-10V driver Included	0-10 driver Included	0-10 driver Included	AO MANUAL OPTION or ROAM smart controls
Warranty	5yr std/10yr option	10 years complete	10 YEARS	10 Years	10 years
LEDs	Included	Included	10 YEARS CREE	10 Years	ABL Comm. Warranty
Drivers	Included	Included	10 YEARS CREE	10 Years	"
Finish	Included	Included	10 YEAR GRAY	10 Years	"
Fixture	Included	Included	XSP1C SERIES	10 Years	"
Labor Allowance	N/A	N/A	NA	N/A	N/A
Comments	Internal Bubble Level D = Dimming Driver; T = 10kV/5kA Surge Protection	3-level dimming standard Rubber seal around arm standard Mounting bubble standard 4-bolt option for mounting N/C Reversible mounting plate for different pipe OD Parts MADE IN Malaysia, assembled in CA (meets BAA)	Multi-level dimming standard	Bird Guard Mounting bubble	Multi-level dimming standard Mounting bubble standard

Using TEN’s Performance Characteristics Matrix, TEN worked with the City of Harrisburg and various national manufacturers to identify a prominent area for the street lighting samples to be installed. Upon installation, the City then invited residents, public works officials, and public safety professionals to vote for (or weigh in on) their favorite fixture using such variables as light output, design, ease of operation, insect guard availability, and several others. Two (2) samples of each manufacturers’ LED cobra head were installed by the city for purposes of determining ease of installation and maintenance, and one (sample) of each was “table-topped” in City Hall so that city personnel and the public could view and inspect the options for selection.

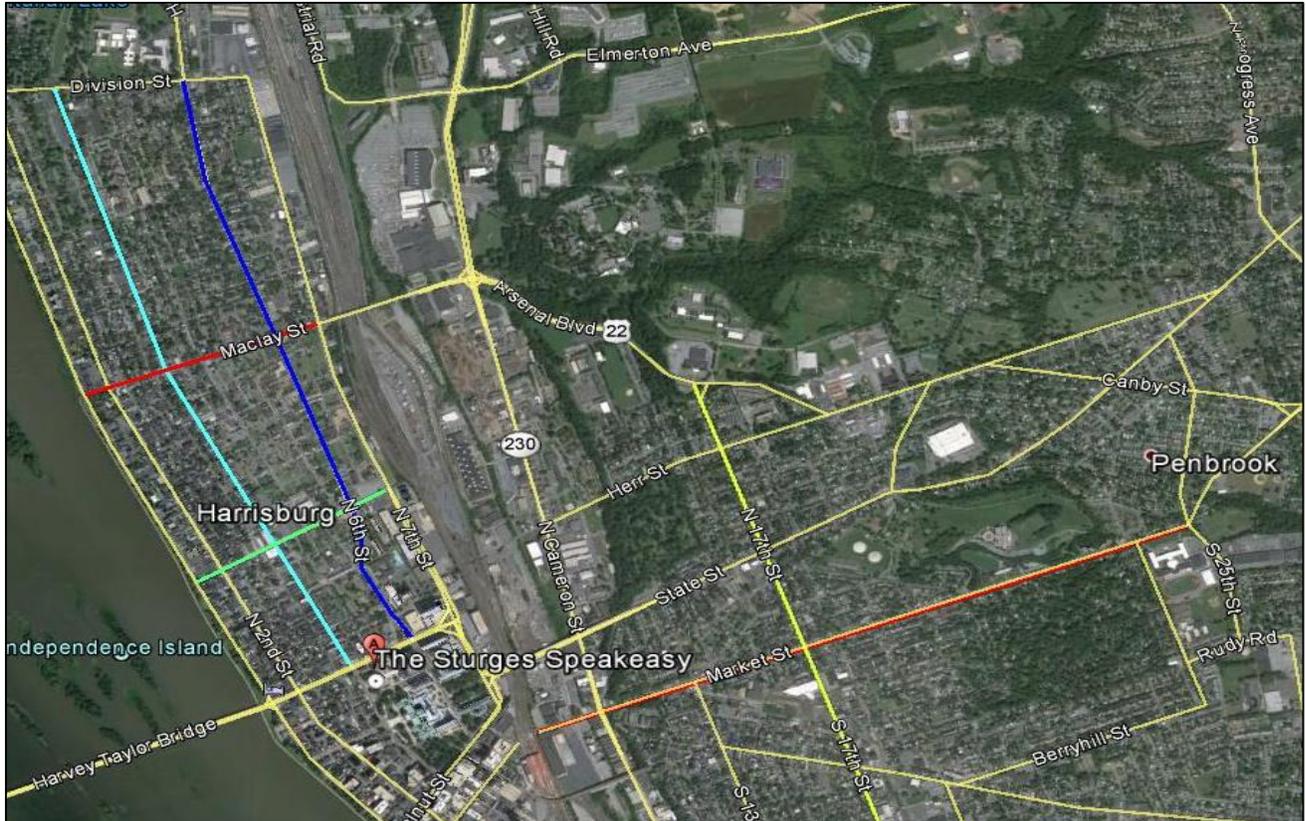
After residents and city officials weighed in on the fixtures installed and displayed in City Hall for public view and inspection, the City made a final selection (Eaton/Cooper) of the cobra head fixture they believed best met the needs of the City of Harrisburg after considering all of the variables.



***Picture of samples “table-topped” in Harrisburg City Hall for Inspection -
TEN Will Deliver World-Class Options for PM Pilot Projects***

TEN will work with each of the Awarding Authorities to determine if incorporating a pilot would help in the education of the new technologies available and in the final selection of a new LED street lighting fixture. As a feature of TEN’s approach to lighting design and street lighting, each PM that decides to engage in a pilot process will not face any additional installation costs. TEN will work with the lighting manufacturers and the distributors to negotiate free samples.

Using a similar matrix to those that have been prepared in our other street lighting projects, TEN will also work with each PM to obtain products for comparison that detail each characteristic – everything from color temperature to ease of installation to length of manufacturer’s warranty – and that are appropriate for various locations throughout each PM. Special consideration of course will be available for areas where the PM may want increased or decreased lighting. Again, in Baltimore and in Harrisburg, TEN developed a lighting design that allows City officials to improve light levels in target communities and safety corridors.



Depiction of pre-design mapping work for City of Harrisburg’s Emergency Evacuation Routes

Finally, TEN will deliver to each PM a new updated GIS system that identifies the desired characteristics of the new LED street lighting system, an accurate inventory of all new products purchased, and all expected costs, savings, financial paybacks, and potential incentives for the new street lighting system.

b. Smart Controls and other PM Smart City Solutions

Smart City Media (TEN partner)

A Smart City Media LLC, smart media grid enables communities to be better connected. In fact, the platform uses information kiosks to create a better connected community, where citizens can easily discover events, programs, deals and other relevant and important information as they walk down the street. The system also allows public safety and homeland security officials to not only see and assess emergency situations but also to broadcast alerts and provide mobile updates to residents in targeted locations.



This platform also serves as a significant revenue generation opportunity. Advertisers can develop targeting content and pay premium fees to broadcast their individual content. This revenue opportunity can net up to several hundreds of thousands of dollars for each City to be used to pay for light grid infrastructure improvements, public services, or reinvested into the smart street lighting system.

Intellistreets, by Illuminating Concepts (TEN partner)

In addition to generating revenue and providing public safety and homeland security officials with critical information, smart city technologies can also be used to broadcast audio messages to residents, serve as a mechanism to update residents on traffic closures, and use colors and lights to alert individuals to an emergency situation.

Intellistreets has designed, patented and manufactured electronic modules (ECM) that may be embedded or attached to almost any form of structure or luminaire. The system uses wireless technology – not Wi-Fi (and therefore potentially less “hackable” – to communicate with individual luminaires, and streetlights are able to conserve energy up to 70% over conventional luminaires. Using wireless eliminates the high construction costs of wiring, cabling, and conduit and allows for integration within virtually any modern architectural control system for synchronization of any feature within and around the Intellistreets system.



Finally, the system can be used for entertainment purposes and allow the City to use of radio broadcast from playlists while a wide range of additional sensors can be utilized for exciting pedestrian user interaction.

For more information, please see Attachment 2: Smart Cities Technology

6. Installation & Maintenance

Installation Management

On-Site Management – TEN will provide daily management while each project is on-going. TEN’s project managers will be available to coordinate with contractors, utilities, and PM operations personnel to evaluate progress and activity daily. TEN’s project managers will also provide regular emailed progress reports and updates from our proprietary cTEN construction management program.

Records - TEN will manage and maintain daily progress information and track quantities, contractor payments, and change orders. We will prepare and recommend for approval, periodic installation quantities satisfactory to each PM, such as monthly.

Meetings - TEN will conduct bi-weekly on-site job progress meetings for each project with Project Management representation in attendance as needed. We will attend/facilitate pre-job and preconstruction conferences and all job related meetings. TEN will discuss issues and actions to be taken with all responsible parties, and dates when issues are to be resolved.

Change Orders – TEN will review and negotiate costs for additional extra and force account work. TEN’s team can provide detailed engineer’s cost estimates, and our project managers will document the contractor’s work force for any extra work that may be required or requested.

Schedule – TEN will develop, monitor and maintain a master project schedule for the entire project (for individual Awarding Authorities, and in totality for MAPC) to integrate and coordinate the activities of the various ongoing design and construction activities and contracts.

PM Assistance – TEN will provide ongoing advice, make recommendations, draft and prepare correspondence for signature on specific utility, structure, roadway, environmental, or community related problems that may occur during construction. TEN will coordinate and participate in public relations, including personal contact, interviews, and attendance at meetings requested by a PM. TEN will assist in the preparation of news releases to the public. Importantly, TEN will render assistance to each PM in resolving any contractor claims in an expeditious manner, as well as assist in the resolution of any property owner concerns.

Incentives/Rebates – TEN will process utility rebate applications and provide supporting documents. A more detailed approach is listed in the “Utility Rebate and Coordination” section below.

Final Inspection – TEN will conduct spot inspections in accordance with the RFP, a final inspection, and semi-final inspection if directed, and generate a punch list of work to be completed for each contract. TEN will monitor the punch list until it is complete. TEN will provide written notice to each PM when all project work is complete and recommend project acceptance.

Safety Monitor – TEN will provide an individual experienced with safety programs in construction to serve as each PM’s agent and representative in matters of construction safety, specifically one with experience which directly relates to state and local safety laws, including statutes, rules, regulations, and ordinances. Tasks will include the following: a) Review the timeliness of safety and accident prevention procedures on each Project and review and accept Contractor Safety Programs; b) In the event certain individuals are found to be continually in violation of safety requirements, direct the contractor to remove the individual employee, or to invoke any other contractual remedy deemed appropriate; c) Observe and monitor Contractor compliance with OSHA, the PM, and local and state laws and regulations; d) Periodically attend Foremen’s ‘tool box’ safety meetings and evaluate effectiveness; e) Review and accept Contractor emergency and safety plans and procedures; f) Organize and participate in monthly site inspections and report on findings; g) Coordinate the PM’s general and specific safety concerns with the Project; h) TEN’s involvement in the Safety of each Project shall in no way relieve or decrease the Contractor’s obligation for safety.

Recycling and Disposal Management - TEN will develop the strategy, identify vendors, and manage the overall process. Collected materials will be gathered including but not limited to capacitors, mercury containing devices, drums, bulbs, and ballasts and placed in an accumulation area. For each project, accumulation sea containers will be stored at strategic locations for ease of disposal. These locations, when selected, will provide several advantages; most notably the fact that it is a covered and relatively sealed environment. Hazardous products will be kept in the original containers unless they are not re-sealable. The original material safety data sheets (MSDS’s) will be retained and available for review by Awarding Authorities. If surplus product must be disposed, disposal requirements set forth by the local, State, and Federal regulations will be followed as applicable. During the collection of materials, the selected recycling and disposal management vendor will ensure and certify that the integrity of the equipment or containers is sound. If the integrity is compromised, the vendor will immediately re-pack the containers or equipment. Temporary containment, if required, will be constructed of polyurethane

sheeting and oil socks. The sheeting will be placed under the affected areas and oil socks will be placed around the perimeter of the sheeting.

- **High Intensity Discharge Lamps (Mercury / Metal Halide / Sodium Vapor)** - These bulbs will be removed intact and will be packed in DOT drums containing insulating material in order to prevent breakage. The drums will then be labeled and shipped to an approved disposal facility. Documentation will be provided for the transporter prior to removal from the site.

7. Construction Administration

TEN will work with each PM to developing bidding documents for the installation of street lighting systems. Led by our Director of Construction and Senior Lighting Designer - TEN will assist in the review of all bid documents to confirm that each specification is addressed and met by the respondents.

TEN recommends maintenance on a time and materials basis due to the extremely low failure rate of LEDs (less than 1%) and the availability of “attic stock”. Alternatively, TEN will offer to undertake a maintenance protocol which also provides a labor warranty directly to the PM, and administers the materials warranty provided by the fixture manufacturer.

TEN’s specifications for Installation and Maintenance Contractors will include, but will not be limited to, the following:

- Description of Work, Required Installation Schedule, Order of Streets or Areas to be Retrofitted, References, Submittals, Quality Assurance, Commissioning Assistance, Warranty, Installation Plan, Field Quality Control, Adjusting & Cleaning, Disposal, Availability of Maintenance Services, and Safety Record.

In addition to the language listed above, TEN will also include language relating to platform training for TEN’s proprietary project management software (cTEN), fixture recycling, traffic control and flagging, obtaining permits, or any other goals required of the PM, such as M/W/DBE participation goals.

After working with each PM to determine the minimum requirements for installation and maintenance contractor(s), and after Invitations for Bids (IFB) have been issued by the PM, TEN will review each bid to confirm which vendors have met the minimum criteria, and will deliver to each PM a concise summary of those bids for purposes of evaluating desired services and selecting and approving a contractor.

All subcontractors will perform their work under the direction of TEN’s in-house construction project management and will be required to use TEN’s cTEN technology platform (for project progress reporting) that will enable each PM, and TEN’s project team, to receive daily installation updates. Our project management team also will be responsible for training, preparing customized Operations & Maintenance (O&M) manuals, and overseeing project commissioning.

TEN will conduct spot inspections in accordance with the RFP, a final inspection, and semi-final inspection if directed, and generate a punch list of work to be completed for each contract. TEN will monitor the punch list until it is complete. TEN will provide written notice to each PM when all project work is complete and recommend project acceptance.

For example, TEN is currently installing LED street lights in the **City of Baltimore**. In order to keep the local community and city officials up-to-date on the progress of the project, TEN coordinates weekly briefing documents. A sample bi-weekly report (TEN prepared for the City of Baltimore) can be found in Attachment 3.

8. Acquisition of Streetlights

TEN has been closely monitoring the case that has been proceeding in front of the Maine Public Utilities Commission and the significant involvement of the PMs through the MSLG. If asked to do so, TEN will undertake to advise each PM to assist them in completing the acquisition of the street lighting system from Central Maine Power. The bulk of such negotiation of course is the Net Book Value (NBV) of the system, as well as the specific requirements (approved by the MPUC) for the PM to take ownership of the system from CMP.

TEN will specifically follow the guidelines and procedures currently being developed (if finally approved) in strict conformity to that which is required – including whether or not fusing must be accomplished by CMP or, as the case may be, it is legally permissible for someone else to install the required fuse.

Nevertheless, TEN has dedicated staff on hand (who are former utility company executives), who are available to diplomatically negotiate and finalize the various acquisition documents between the PM and CMP.

Currently, TEN is assisting the City of Harrisburg, PA in negotiating the acquisition of several hundred remaining street lights, which are the only remaining street lights in that city that are still owned by the local utility.

9. Rebates/Incentives

Prequalification Application – TEN will repair and submit on each City's behalf a prequalification application with Central Maine Power to begin the rebate and incentive program process, and will follow through with such application until all amounts are received that are due to each City.

Rebate Program Submission – TEN will establish and maintain spreadsheets for any products eligible for rebates, and will submit rebate applications per the program's instructions (as completed or at the end of construction) to the applicable utility provider. Upon receipt from each City, TEN will submit itemized receipts or invoices with the manufacturer, model number, and purchase price of each qualifying product in addition to supplying manufacturers' specification sheets, as well as submitting any other documentation required by Central Maine Power to obtain available rebates.

Final Submission – TEN will compare final project quantity and products with final rebate submission, and will communicate with Central Maine Power to confirm that final submission has been submitted for approval.

Receipt and Payment – TEN will coordinate with each City, Central Maine Power to ensure final submissions and payment of rebates and incentives has been completed.

For this initiative, TEN will seek any other rebates and financial incentives available for each PM. For example, as part of TEN's street lighting conversion for the City of Bethlehem (PA), TEN obtained \$211,380

in rebates directly paid to the city by the local utility. In the case of the City of Harrisburg, TEN assisted in facilitating a \$500,000 grant awarded to Harrisburg specifically intended for the purchase of equipment related to Harrisburg's LED street lighting conversion, as well as applying for \$277,374 in direct-pay rebates to the city under Pennsylvania's Act 129 utility rebate program. As certain incentives are time and program sensitive, TEN will undertake careful planning to optimize and obtain maximum value of any and all incentives available to each PM.

F. Value Added Services

None Additional.

G. Additional Information

Please refer to the Attachments.

H. Project Schedule

TEN will comply with the project schedule identified in the RFQ.